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Keywords: Monetary Policy, Reserve Bank of India; Unconventional Monetary Policy; Bond Yields; Forward Guidance; Pandemic

JEL Code: E44, E52, E58, G10

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I. Introduction

During the Covid-19 pandemic major central banks all over the world resorted to a wide variety of policy actions in order to provide much-needed support to the respective economies that were severely impacted by this unprecedented shock. These ranged from conventional monetary policy actions such as reductions in the short-term interest rates to unconventional announcements such as extended lending programmes, asset purchases and forward guidance. The primary objective of these actions was to inject liquidity into the system and maintain the orderly flow of credit from the financial intermediaries to the real economy. With the pandemic having subsided and the same central banks trying to exit the policies of abundant liquidity injection, it is now worthwhile to investigate the impact of these monetary policy actions on the financial markets. Against this background, in this paper we empirically analyse the bond market impact of the conventional and unconventional monetary policy actions announced by the Reserve Bank of India (RBI) since the start of the pandemic. We focus on the bond market as it is one of the most important links in the overall monetary transmission mechanism[1].

India offers an interesting case study to examine this issue for two main reasons. While in the developed countries, the governments announced massive fiscal stimulus packages in the wake of the pandemic in order to stimulate demand, in India, much of the heavy lifting was done by the RBI. Given the limited fiscal space (fiscal deficit of the central and state governments in the pre-pandemic period was close to 10 percent of GDP), the fiscal responses of the government were mostly restricted to providing relief measures to the disadvantaged sections of the Indian population. This led to considerable expectations in the financial markets that the RBI would provide the necessary support to the formal sector of the economy including both financial and non-financial firms.

Secondly, the RBI which had formally adopted inflation targeting in 2016, had not resorted to unconventional monetary policy (UMP) actions in as big a way as for example the US Federal

[1] During the pandemic, the growth rate of non-food bank credit fell dramatically (to six decades low of around 5-6 percent) owing to heightened risk aversion in the banking sector, and hence transmission through this channel was seriously impaired.

Reserve or the European Central Bank at any point of time in the pre-pandemic period[2]. This makes a study of the RBI's pandemic-time actions even more interesting. Not only did the RBI undertake different types of UMP actions they also provided explicit forward guidance during the pandemic in order to anchor the expectations of the market participants. The objective of the conventional as well UMP actions was manifold including, aiming to improve monetary policy transmission, facilitating credit flow from banks to the rest of the economy, easing liquidity constraints in specific sectors, reducing financial stress in markets and maintaining financial stability (Patra and Bhattacharya, 2022).

Moreover, anecdotally another important goal seemed to be to keep the government's borrowing costs in check. During the pandemic the Indian government's debt to GDP ratio reached close to 90 percent of GDP implying unprecedented levels of borrowing by the government from the bond market. As a result, one of the main objectives of the RBI's UMP announcements arguably was to lower the bond yields in order to support the government borrowing program. This was alluded to several times in the RBI's official statements as well.

Our paper makes three main contributions in studying the bond market response to RBI's pandemic-era monetary policy announcements. First, we study the media reactions to some of the major monetary policy announcements during our sample period which runs from March 2020 to June 2022. While using the change in financial market prices is a natural alternative to study the response to central bank announcements (and we also do this later in the paper), the narrative analysis using media articles allows us to provide more context in understanding the impact of these announcements. This is a novel aspect of our paper relative to the existing literature that analyzes the pandemic policy announcements of the RBI (see for example Patra and Bhattacharya, 2022; RBI, 2021). Overall, we find that the narrative in the media is consistent with the financial market price changes. Both sources suggest that only a handful of the UMP actions and especially those in the early part of the pandemic took the markets by surprise. For instance, the market seems to have been more surprised by the first announcement

[2] The official inflation target in India has been fixed at 4% headline CPI inflation with a +/- 2% band on either side. As Appendix Figure A1 shows, barring a brief spell in 2021, headline inflation has been consistently above the 6% upper threshold of the inflation targeting band in recent years. Even in 2021, inflation remained closer to the upper threshold rather than the target level of 4%. One-year ahead inflation expectations were also above the target level during our sample period.

of the Targeted Long-Term Repo Operations (TLTRO) (both in March and April) and the Operation Twist (OT) announcement in April. However, we do not find much of an effect of the GSAP (Government security acquisition program) announcements that happened more than a year into the pandemic in April and June 2021. For the conventional announcements, the markets seem to have been most surprised when the RBI began tightening monetary policy by raising the policy interest rates in the period from April to June 2022, in response to elevated inflation levels.

Second, we undertake a systematic investigation of how and why RBI announcements moved government bond yields since the start of the pandemic, focusing on both conventional and UMP announcements. The total effect of the RBI's surprise announcements in the first one and a half years of the pandemic was to reduce the yield on 10-year government securities (GSec) by at least 40 basis points. This accounts for the total fall in the 10-year GSec during that time. This effect was driven both by conventional and UMP actions. Consistent with the narrative analysis, we find that only 5 announcement dates, all in the first few months of the pandemic were responsible for the cumulative 40 bps fall in the 10-year yield. Four of these dates contained UMP announcements, such as TLTRO and Operation Twist (OT). Notably the GSAP measures announced by the RBI in April and June 2021, during the second wave of the pandemic did not have any discernible impact on the bond yields. In other words, much of the impact of the RBI's announcements was front-loaded in the first six months of the pandemic.

We also investigate if there are any indirect effects of the UMP announcements. We find evidence of the TLTRO announcements working through a signaling channel (see for eg., Bauer and Rudebusch, 2014). The idea behind this channel is that markets perceive the announcement of an unconventional monetary policy by the central banks as a signal to keep short term interest rates lower in the future. We explore this channel using data from Overnight Indexed Swap (OIS) rates. While TLTRO announcements had a pronounced signaling channel effect of lowering short to medium term interest rates, we do not find this for the other UMP actions.

Finally, we assess the potential impact of the RBI's forward guidance on the bond markets. The RBI traditionally did not offer forward guidance (Mathur and Sengupta, 2019; Lakdawala and Sengupta, 2021) as part of its monetary policy statements. However, during the pandemic forward guidance gained prominence in the RBI's communication strategy (Talwar et al., 2021)

primarily to reiterate the accommodative stance of monetary policy. We use OIS rates and the approach of Gurkaynak et al. (2005) to construct target and path factors which captures surprise changes to the short-term policy rate and surprise movements in the medium-term rates, respectively. Specifically, the path factor moves in response to surprise changes in the RBI's forward guidance. We find that forward guidance shocks continued to have an expansionary effect on longer term rates not only in the first year of the pandemic but through early 2022. The biggest path factor movements however came about in 2022 when the RBI began tightening monetary policy in order to tackle high and rising inflation[3]. We also find that while in the pre-pandemic period, the target factor was the main driver for bond yields, in the pandemic period, the path factor was more important. This underscores the importance of the RBI's forward guidance over the last two years.

While there exist by now several studies that analyse the impact of monetary policy actions particularly UMP announcements on bond markets (for eg., Hartley and Rebucci, 2020), to the best of our knowledge there is only a limited literature on this topic for emerging economies like India especially for the pandemic period (notable exceptions are Patra and Bhattacharya, 2022 and Talwar et al., 2021). We address this gap and contribute to this nascent literature by conducting a narrative analysis using media reports which enables us to study market's reactions to the announcements and also by looking at both expansionary and contractionary announcements by the RBI.

II. Monetary announcements during pandemic and market reactions

The RBI announced a slew of conventional and unconventional monetary policy (UMP) measures during the pandemic. Conventional measure refers to changes in the short-term policy rate (i.e. repo rate). According to the inflation targeting mandate of the RBI the monetary policy committee (MPC) is responsible for deciding the policy repo rate. As per the RBI's liquidity management framework, the repo rate lies in a corridor (referred to as the Liquidity Adjustment Facility or LAF corridor) whose floor is decided by the reverse repo rate and the ceiling is

[3] With the shift in focus of the RBI to inflation stabilization in the later part of the pandemic, it is natural to wonder if this changed the monetary transmission mechanism. However, due to short sample, we do not test if the monetary transmission of target and path factors to bond yields changed but it is an interesting question left for future research.

decided by the marginal standing facility (MSF) rate (Dua, 2020). This corridor used to have a fixed width in the pre-pandemic period implying that once the MPC decided the repo rate the other two rates were automatically determined. Till the pandemic the reverse repo rate had never been changed in isolation by the RBI. However, during the pandemic, on April 17, 2020 the RBI cut the reverse repo rate by 25 basis points without changing the repo rate, as a result of which the LAF corridor became asymmetric with a downward bias. This was done predominantly to discourage the banks to park their excess liquidity with the RBI. However, this move would be considered an UMP action because it was not part of the conventional monetary policy statement of the MPC and did not entail a change in the policy rate.

In addition to this, the RBI announced several other UMP actions during the pandemic which we have described in the Appendix in Table A1 and A2. The rationale and the nature of the policy actions, the transmission channels and the scale of operations are considered the main distinguishing features of UMP announcements (Patra and Bhattacharya, 2022; BIS, 2019). RBI undertook three main types of UMP actions, namely TLTRO, Operation Twist and G-SAP. TLTRO was introduced to provide liquidity to specific sectors and entities experiencing liquidity stress (Talwar et al, 2021). Operation Twist (OT) was aimed at compressing the term premium and flattening the yield curve. G-SAP was an upfront commitment by the RBI on the size of GSec purchases in contrast to the regular discretionary purchases through open market operations (Patra and Bhattacharya, 2022). In this section we describe a few of the major announcements and analyse the financial market's reaction to these announcements as understood from articles published in the Economic Times (henceforth ET), a leading financial daily in India. In Table 1, we list some of the major announcement dates during our sample period.

The announcement of the nationwide lockdown on March 27, 2020 was followed by the Finance Minister announcing a fiscal package of Rs. 1.7 lakh crore on March 26, 2020. The market viewed this mostly as a relief package for the country's poor in the wake of lockdown, without any demand stimulus per se, or any relief for the industry, including the hardest hit sectors such as aviation, and hospitality among others. This created some expectation that the RBI would announce some major policy actions to provide much needed support to the economy.

Table 1: Major Monetary Policy Announcements during the Pandemic

Date	Policy Type	Details
March 27, 2020	Both CMP and UMP	Repo rate was cut by 75 bps to 4.4%; Reverse repo rate was cut by 90 bps to 4%; CRR was cut by 1%; TLTRO 1.0 announced
March 30, 2020	UMP	TLTRO next tranche announced
April 17, 2020	UMP	Reverse repo rate cut by 25 bps to 3.75%; TLTRO 2.0 announced
April 23, 2020	UMP	Operation Twist announced
May 22, 2020	CMP	Repo rate cut by 40bps to 4%; Reverse repo rate down to 3.35%.
April 07, 2021	UMP	GSAP announced for the first time
April 08, 2022	CMP	RBI hikes Standing Deposit Facility rate (new floor of LAF corridor) to 3.75% from 3.35%
May 04, 2022	CMP	RBI increases repo rate by 40bps to 4.4%

Note: The above table shows some of the major monetary policy announcements during our sample period from March 2020 to June 2022. CMP refers to conventional monetary policy announcements while UMP refers to unconventional monetary policy announcements. CRR refers to the cash reserve ratio.
Source: Reserve Bank of India (URL: www.rbi.org.in).

The RBI preponed its scheduled monetary policy meeting from April to March 2020. On March 27, 2020, in keeping with the expectations, in an unscheduled monetary policy announcement the RBI announced a big expansion in monetary policy. This included a 75 basis points (bps) cut in the policy repo rate, a 90 bps cut in the reverse repo rate, and a 1 percent reduction in the cash reserve ratio (CRR). Simultaneously, the RBI announced an unconventional monetary policy in the form of the TLTRO (Targeted Long-Term Repo Operation or repurchase operation in government securities). While the RBI had been doing LTRO (Long-term repo operations) since February 2020 to improve monetary policy transmission, this was the first time it announced a targeted version of this program. The idea was that the banks would use the liquidity available under this scheme to invest in corporate bonds or commercial paper or debentures, and this would keep credit flowing in the economy. These announcements together were meant to inject Rs 3.74 lakh crore liquidity in the system, which amounted to about 1.8 percent of India's GDP.

The RBI's announcement came at a time when the market was already expecting a considerable monetary policy support given the shock of the pandemic and the lockdown. At the same time in

some quarters, the magnitude and variety of measures announced may have led to some element of surprise. For example, some analysts noted that *"The RBI has surpassed expectations by delivering more than what the market anticipated, and its promise to 'do whatever it takes' has come good."*[4]

Over the next couple of weeks, the RBI announced more TLTRO auctions. While these announcements were lauded by the analysts and markets in general, the overarching sentiment seemed to be that the government was not going to announce a sizeable fiscal stimulus because of constrained fiscal space, and hence the RBI would have to do much of the heavy lifting; however, the measures announced by the RBI did not seem adequate or appropriately targeted. For example, market expected the RBI to follow the footsteps of the US Federal Reserve, and directly start buying corporate bonds. The ET reported on April 15, 2020: "*RBI, which has been reluctant in following the sweeping actions of Federal Reserve, could use Sec 17 of the RBI Act to extend bond purchases to include corporate bonds with sufficient haircuts*."[5]

There were also fears that given the high fiscal deficit of the government on account of reduction in tax revenues triggered by the lockdown, the government would need to significantly increase its borrowing from the market and this could push up bond yields. This led to expectations that the RBI would need to do more in order to keep the bond yields in check and support the government's borrowing program. "*The RBI should consider another package of wide ranging measures.....The growth impact from Covid-19 due to required measures such as the lockdown, will require active support from the RBI to ensure that Government borrowing for the current financial year is conducted smoothly (ET, April 15, 2020)".*

Almost in response to the market's concerns, the RBI announced TLTRO 2.0 on April 17, 2020 along with a 25 bps reduction in the reverse repo rate, in yet another unscheduled announcement. The disruptions caused by the pandemic severely and perhaps disproportionately impacted the small and mid-sized corporations, including non-banking financial companies (NBFCs) and micro finance institutions (MFIs), in terms of access to liquidity. Yet majority of the funds

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[4] https://economictimes.indiatimes.com/markets/stocks/news/rbi-brings-out-heavy-artillery-to-fight-corona-crisis-heres-what-experts-say/articleshow/74841412.cms

[5] https://economictimes.indiatimes.com/markets/stocks/news/rbi-to-step-up-liquidity-measures/articleshow/75150864.cms

available by the banking sector through TLTRO 1.0 (announced on March 27, 2020) was deployed to buy bonds issued by public sector entities and large corporations. Hence, in order to support the more disadvantaged sections of the economy, the main idea behind TLTRO 2.0 was that the funds availed by banks under this scheme were to be invested in bonds issued by NBFCs, with at least 50 per cent of the total amount availed going to small and mid-sized NBFCs and MFIs.

This unscheduled announcement came as a surprise. ET reported on April 17, 2020: "*In a surprise second media briefing in a month, RBI Governor Shaktikanta Das on Friday noted that the deployment of targeted TLTRO 1.0 largely went to large PSUs (public sector undertakings) or large corporations. To begin with, the central bank will conduct TLTRO 2.0 worth Rs 50,000 crore."*[6] This announcement also led to expectations that the RBI would undertake further interest rate reductions in the next meeting. *"India's central bank governor laid the ground for more interest rate cuts as he took a number of steps to boost liquidity and support lenders" (ET, April 17, 2020)*[7]

The other major UMP announcement by the RBI in April 2020 was that of the Operation Twist (OT). This specific type of UMP which was a variant of the quantitative easing used by the US Fed in 2012, had been done earlier by the RBI in December 2019. During the pandemic period RBI announced the first OT on April 23, 2020. The objective of this UMP action was to alter the slope of the yield curve through targeted intervention at specific maturities (Patra and Bhattacharya, 2022), and primarily to lower the yields on long-term GSecs. This announcement led to nearly 16bps drop in the 10year GSec yield, the biggest drop since March 27, 2020. Bond markets interpreted this announcement as an indirect signal of the RBI's intention to monetise part of the government's fiscal deficit. Given that the RBI had not engaged in deficit monetisation for decades, the nature of this specific OT announcement seemed to surprise the markets. "*While the RBI earlier this year conducted similar "twist operations", Thursday's announcement raised eyebrows as the RBI will now be selling T-bills it sold in an auction a day*

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[6] https://economictimes.indiatimes.com/markets/stocks/news/economists-hail-rbi-steps-say-tltro-2-0-a-much-needed-move/articleshow/75197723.cms

[7] https://economictimes.indiatimes.com/markets/stocks/news/rbi-signals-rate-cuts-as-it-boosts-liquidity/articleshow/75206649.cms

earlier, in what traders say is a clear indication the RBI itself bought a large chunk of that offering."[8]

The next set of conventional monetary policy announcements were done on May 22, 2020 when the RBI slashed the policy repo rate by another 40 bps to bring it down to the lowest ever rate of 4 percent; accordingly, the reverse repo rate came down from 3.75 percent to 3.35 percent. With this, the RBI cut the repo rate by 115 bps and the reverse repo rate by 155 bps in the first two months of the lockdown. This marked the end of the rate cutting cycle during the pandemic. Given the continuing troubles in the economy amidst the protracted and severe lockdown, the reaction of the market to this round of monetary expansion was lukewarm. ET reported on May 22, "*However, while the monetary policy measures announced today are certainly necessary, they can hardly be deemed to be sufficient, in the face of severely weakened demand conditions economy-wide, following two entire months of severe economic lockdown."*[9]

The next significant UMP announcement by the RBI took place on October 9, 2020 when the RBI unveiled the on-tap TLTRO scheme. The focus of this scheme was revival of activity in specific sectors that have both backward and forward linkages, and multiplier effects on growth. Initially this scheme was meant for five sectors; subsequently 26 stressed sectors were brought under this ambit by December 2020 and by February 2021 the NBFCs were also included i.e. liquidity availed by banks through this scheme was to be deployed to buy bonds from entities in these sectors, as well as lend to these specified sectors. The market expectation in the run-up to this monetary policy meeting was that status quo would be maintained. "*The newly-constituted Monetary Policy Committee (MPC) of the Reserve Bank began its three-day deliberations on Wednesday, amid expectations that the central bank will maintain status quo on the benchmark lending rates in view of hardening inflation. Industry bodies are of the view that the RBI should*

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[8] https://economictimes.indiatimes.com/markets/bonds/rbi-special-operation-leaves-traders-wary-but-bonds-rally/articleshow/75327136.cms

[9] https://economictimes.indiatimes.com/opinion/et-view/et-view-welcome-steps-by-rbi-it-can-surely-do-more/articleshow/75895544.cms

maintain its accommodative stance on the policy interest rates in the wake of serious challenges in limiting contraction in the economy due to COVID-19 pandemic" (ET, October 7, 2020)[10].

There was no expectation per se of further liquidity injection measures and hence the market reaction in general was that the RBI had done more than what was expected. This was also when the RBI and the monetary policy committee (MPC) gave an explicit forward guidance about the future path of monetary policy. We discuss this in greater detail in the next section.

The RBI announced G-SAP on April 7, 2021 marking the first time the central bank pre-committed to a specific size of GSec purchases. This was on the lines of US Fed's Large-Scale Asset Purchases L-SAP programme after the implosion of Lehman Brothers. Between April and June 2020 the central bank said it would aim to buy Rs 1 lakh crore bonds under G-SAP. To a large extent this was expected by the financial markets. After the Finance Minister announced a massive borrowing (Rs 12.05 lakh crore) plan for 2021-22 in the Union Budget of February 1, 2021, bond yields began hardening. There was widespread expectation in the market that the RBI would provide some clarity about its GSec purchase plan for the rest of the year and maybe even come out with an OMO calendar, in order to lower the yields. ET reported on April 5, 2021: "*But investors would need clarity in communication from Governor Shaktikanta Das on his agenda for the bond markets, which have lately been roiled by hardening yields."*[11]

In other words, it seems that compared to the UMP announcements towards the first half of our sample, such as TLTRO 2.0 or OT of April 23, 2020, the market was much less surprised by the G-SAP announcements of 2021.

Finally, from April 2022 onwards the RBI began tightening monetary policy in a series of conventional announcements which entailed an increase in the policy repo rate. While the market had begun expecting from December 2021 onwards that the RBI would start the policy normalisation in 2022, yet when the announcements were made the market seems to have been surprised to a considerable extent. We discuss this more in the next section.

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[10] https://economictimes.indiatimes.com/news/economy/policy/rbis-monetary-policy-committee-begins-deliberations-to-announce-policy-review-on-friday/articleshow/78532290.cms

[11] https://economictimes.indiatimes.com/news/economy/policy/reserve-bank-expected-to-hold-rates-this-week/articleshow/81904477.cms

III. Analyzing the bond market response to monetary policy announcements

Appendix Figure A2 plots the yield on the 10-year GSec from March 2020 to June 2022. This interest rate started at 6.3% in March 2020 and drifted down towards 5.8% by June 2020. Then it hovered around 6% for rest of the year before beginning its gradual rise over the next year and a half to finish around 7.3%. What were the effects of the RBI's actions on this trend in long-term term interest rates? We aim to shed light on this question in this section.

We will focus our attention on the announcement dates where RBI released a statement on their regularly scheduled meeting dates and also include days when the RBI made any unscheduled announcements about conventional or unconventional monetary policy actions. Our sample runs from March 2020 to June 2022. There are 15 conventional RBI announcement days, 34 unconventional announcement days and five days when there were both conventional and unconventional announcements.

We categorize the announcements into "only CMP" which are days with only conventional monetary policy announcement pertaining to the policy repo rate were made. For instance, the MPC announcement of August 06, 2020 to keep the policy repo rate unchanged at 4.00 per cent is classified as an *only CMP* date. Further, days on which only announcements related to unconventional monetary policy measures, such as the TLTRO, GSAP and OT, were made are classified as "only UMP" dates. The announcement of simultaneous sale-purchase OMOs under Operation Twist programme on April 23, 2020 or GSAP 2.0 on July 05, 2021 can be considered *only UMP* dates. Lastly, days on which unconventional measures were announced alongside the conventional policy actions of the MPC correspond to "CMP+UMP" days. The historic policy package announced on March 27, 2020 – reduction in policy repo rate, reverse repo rate, CRR and announcement of TLTROs – is an example of such dual announcement dates[12].

[12] During the pandemic, monetary policy communication by the MPC were accompanied with the announcement of policy measures related to other functions of the RBI, such as regulation, supervision, payments systems etc., by the RBI Governor. These announcements were made under a separate "Statement on Developmental and Regulatory Policies". To that extent, several unconventional monetary policy measures were also announced under such statements and press releases issued by the RBI. We take this into account by separate classification of announcement days as described in the paper. Lastly, since the additional policy measures announced as a part of the separate statement focus on other areas of central banking functions, such as payments systems, banking regulation and supervision, it is assumed not to have any significant impact on bond markets.

While news about RBI actions can potentially be released outside of these dates, it is difficult to disentangle this information from general information about Indian macroeconomy. This motivates our approach of focusing on RBI announcement dates to more clearly identify the causal effect of monetary policy on the bond market.

We start by studying whether RBI announcements moved bond yields more than news coming out on a generic day. Table 2 shows the mean and standard deviation of the daily change in 3-month, 1 year and 10-year government bond yields on the three different categories of RBI announcement days compared with all other days. The daily change is calculated as the change in yields from end of day *(t)* minus yields from end of day *(t-1)*. We have checked that the results are very similar when using a two-day window.

Table 2: Response of Government Bond Yields to Central Bank Announcements during the Pandemic: Summary Statistics

Security	*Only CMP*		*Only UMP*		*UMP+CMP*		*All Other Dates*	
Daily change (%)	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
3M T-bill	-0.041	0.23	-0.018	0.05	-0.172	0.34	0.004	0.04
1Y GSec	0.001	0.17	0.007	0.11	-0.078	0.25	0.002	0.08
10Y GSec	0.029	0.12	-0.005	0.06	-0.028	0.05	0.001	0.04

Note: The above table reports the mean and standard deviation of daily change in government bond yields (3-month, 1-year and 10-year) on days of only conventional monetary policy (CMP) announcements, only unconventional monetary policy (UMP) announcements, a mix of CMP and UMP announcements and all other non-policy days. The sample consists of 10 exclusive CMP announcement days, 29 exclusive UMP announcements, 5 CMP and UMP days and 556 other days during the 27/03/2020 to 31/06/2022 period.
Source: Authors' calculations.

The table shows that bond markets are clearly responding more to RBI announcements compared to all other days. For both conventional and unconventional policy announcements the standard deviation of short-term and long-term yields are higher as compared to all other days. The standard deviation at the shorter end is substantially higher on announcement days, especially when a conventional announcement is involved. It is interesting to note that bond yields move more on announcement days with only conventional announcements relative to days with only unconventional announcements. As we will discuss later, this is consistent with the idea that

there were many days with unconventional announcements that were not surprising to the market and most of the "action" in financial markets happened in the early period of the pandemic.

Table A3 in the Appendix shows similar summary statistics for the pre-pandemic sample with only conventional announcements. Those results show that the pandemic response of bond yields has been similar to the pre-pandemic sample, suggesting that transmission to financial markets is still an important first step in the overall monetary transmission mechanism. Overall, this evidence provides support for our event-study framework that there is some novel information being released on RBI announcement dates.

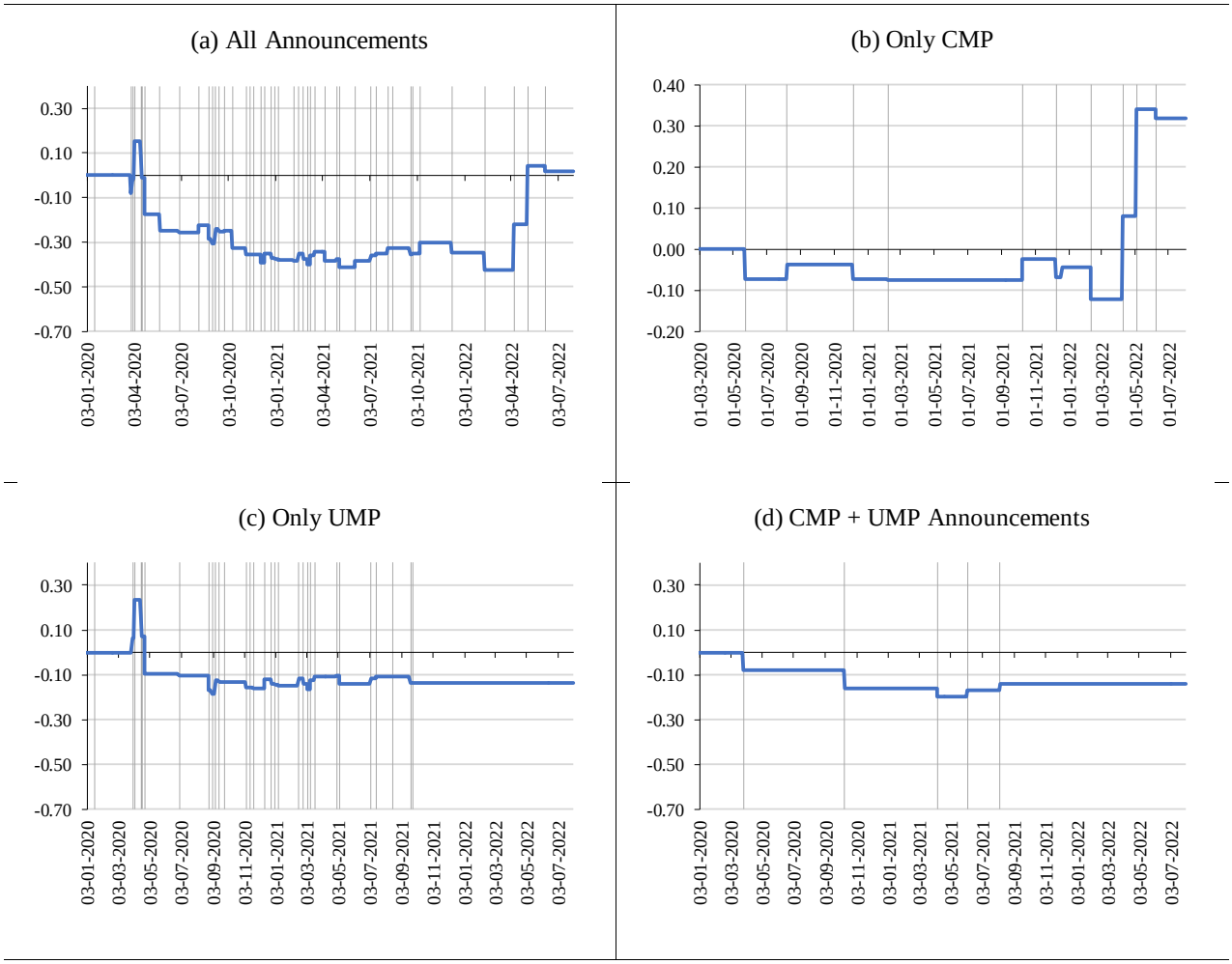
To better understand how bond yields were affected by each RBI announcement we next plot the cumulative change in 10-year GSec on RBI announcement days separating again by only conventional, only unconventional and conventional plus unconventional actions.

Figure 1 shows this cumulative change with the top left panel clubbing all RBI announcements together. In the first few weeks of the pandemic, RBI actions surprised markets in both directions, i.e., 10-year GSec goes up in late March and then down in early April. After this the 10-year GSec fell on RBI announcement days from April all the way until mid-2021. The total effect of RBI announcements in the first year and a half of the pandemic was to reduce the 10-year GSec rate by around 40 basis points. In other words, long-term interest rates would have been 40 basis points higher if not for the surprise monetary policy actions announced by the RBI. From mid-2021 to early 2022 there is no discernible trend in the movement of 10-year GSec on RBI announcement days: interest rates went up on some announcements and went down on others. Starting in April 2022 the RBI started raising interest rates to combat inflation and we can see the corresponding increase in the 10-year GSec.

The remaining three panels show this cumulative change broken down into the three categories of announcements. Up until then, RBI announcements with only unconventional actions contributed roughly 12 basis points in the 40 basis points mentioned above. CMP only dates contributed roughly 8 basis points and CMP + UMP dates contributed the remaining 20 basis points. Next, we will shed more light on which specific dates and RBI announcements had the biggest impact on the bond market. But we just want to wrap up this discussion by noting that

the rise in 10-year yields is driven completely by conventional dates as the last unconventional action in the pandemic occurs on September 2021.

Figure 1: Cumulative Effect of RBI Announcements on Long-term Interest Rates during the Pandemic



Note: The above plots show the cumulative daily change in the yield on 10-year GSec on (a) all policy announcement days; (b) only CMP days; (c) only UMP days; and (d) CMP+UMP days during the pandemic sample. The daily change refers to the difference between yields on 't' and 't-1' day around the policy announcement. The graphs are from January 2020 to July 2022.
Source: Authors' calculations.

III.1. Impact of the UMP announcements

We explored the yield data meeting by meeting and found that there are about 5 announcement days that are responsible for almost the full cumulative 40 basis point change in the 10-year GSec in the first year and a half of the pandemic. Four of these five dates correspond to the announcement of major unconventional actions, two of them correspond to cuts in the repo rate,

with one date which saw both unconventional and conventional actions. The unconventional actions include TLTRO 1.0 announcements on March 27 and March 30, 2020, TLTRO 2.0 on April 17 and Operation Twist announcement on April 23. We report these dates in Table 3 together with the two GSAP dates since combined this includes all the major unconventional announcements. See Table 1 for more details of the policy actions announced on these dates.

Table 3: Change in Sovereign Bond Yields for Major Policy Announcements during the Pandemic

Event	*Date*	*Daily Change (%)*		
		3M	1Y	10Y
CMP + TLTRO 1.0	March 27, 2020	-0.780	-0.521	-0.081
TLTRO 1.0	March 30, 2020	0.040	0.063	0.065
TLTRO 2.0	April 17, 2020	-0.160	-0.189	-0.093
Operation Twist	April 23, 2020	0.010	0.218	-0.164
CMP	May 22, 2020	-0.570	-0.282	-0.073
GSAP 1.0	April 07, 2021	-0.030	0.088	-0.040
GSAP 2.0	June 04, 2021	-0.010	0.006	0.031

Note: The above table shows the daily change in government bond yields of 3-month, 1-year and 10-year maturities on the day of the respective announcement (t) compared with one day prior to the announcement (t-1) for sample period from March 2020 to June 2022.
Source: Authors' calculations.

Table 3 shows the change in the 3-month and the 1-year GSec in addition to the 10-year bond yields. The main purpose of the LTRO was to inject liquidity into the financial system and preserve the orderly flow of credit to households and firms. While this policy was not directly targeting GSec yields, Table 3 shows that it had substantial effects on these yields, especially the first LTRO 1.0 and first LTRO 2.0 announcements. The repo operations were of tenors 1 and 3 years. Thus, we would expect the biggest effect around that maturity. But we instead see that there are bigger effects on 3-month (and 6-month which is not shown for brevity) than the 1-year GSec. What could explain this effect?

One potential mechanism through which this could have happened is the so-called signaling channel of monetary transmission (see e.g., Bauer and Rudebusch, 2014). The idea is that an unconventional monetary policy action is taken by the market as a signal of a more expansionary path for the future path of the policy interest rate. To further investigate whether this channel is

more broadly prevalent for all the TLTRO announcements (there were 6 in total), we use data from Overnight Indexed Swaps. OIS interest rates have shown to be a good proxy for capturing the market's expectations about future RBI actions (see Lloyd, 2018; Rituraj and Kumar, 2021; Talwar et al., 2021; Lakdawala and Sengupta, 2022).

The top right panel of Appendix Figure A3 shows the average effect of the TLTRO dates on OIS rates of maturity 1 month to 1 year. We show both the 1-day and the 2-day changes. The figure shows that OIS rates of all maturities fall on average on TLTRO dates. This is suggestive evidence of the signaling channel of monetary policy affecting government bond yields through expectations of future interest rate changes. Moreover, we find that the average fall in 1-month OIS rates is roughly 20 basis points while that for 1-year OIS is roughly 10 basis points. This provides further evidence for the signaling channel because absent the signaling channel we would expect the bigger effect to happen around the maturity of the loans that were targeted (i.e. 1 to 3 years). Finally (in results not reported here) we find that the OIS 1-month rate falls more on TLTRO 2.0 announcement relative to the TLTRO 1.0 announcements even though TLTRO 2.0 had a much lower offered amount and subsequent fulfillment. Patra and Bhattacharya (2022) report that TLTRO 1.0 announcement of Rs. 1 lakh crores were fully availed but that TLTRO 2.0 announcement of Rs. 50,000 crores were only availed to the tune of Rs. 12,850 crores.

Appendix Figure A3 also investigates whether the signaling channel is present for the other unconventional policy actions. The three other panels show the effect of Operation Twist and GSAP 1.0 and GSAP 2.0. The figure shows that unlike TLTRO, neither OT nor GSAP had any discernible signaling channel effect. Overall, our results point to the signaling channel being an important component of the transmission mechanism of TLTRO but not the other unconventional actions.

Operation Twist (OT) involves the simultaneous open market purchase of government securities at the long-end of the yield curve and open market sales at the short-end. The goal is to lower long-term interest rates while remaining net neutral in terms of liquidity injection into the financial system. Table 3 shows that the first OT announcement on April 23, 2020 was successful in this regard. 10-year GSec yields fell by 16 basis points while there was an increase in 3-month T-bill of about 1 basis point. We might have expected the short end to go up more than just a basis point but here we want to point out that there is a possibility that the direct effect

of open market sales at the short end (which would put upward pressure) are being neutralized by the signaling effect of the announcement (which would put downward pressure).

To explore whether all the subsequent OT announcements had similar effects, we plot the average change in GSec yields across all OT announcements in the pandemic sample (there were 22 of these) in Appendix Figure A4. The figure shows that on average OT announcements did not have the desired effect as there is essentially zero change in the long or the short end of the yield curve on average.

Finally, we note that GSAP 1.0 and 2.0 had negligible effects on the yield curve as seen in Table 3. Overall, these results suggest that unconventional monetary policy actions undertaken by the RBI had substantial effects in lowering government bond yields. But these effects were mostly clustered towards the beginning of the pandemic.

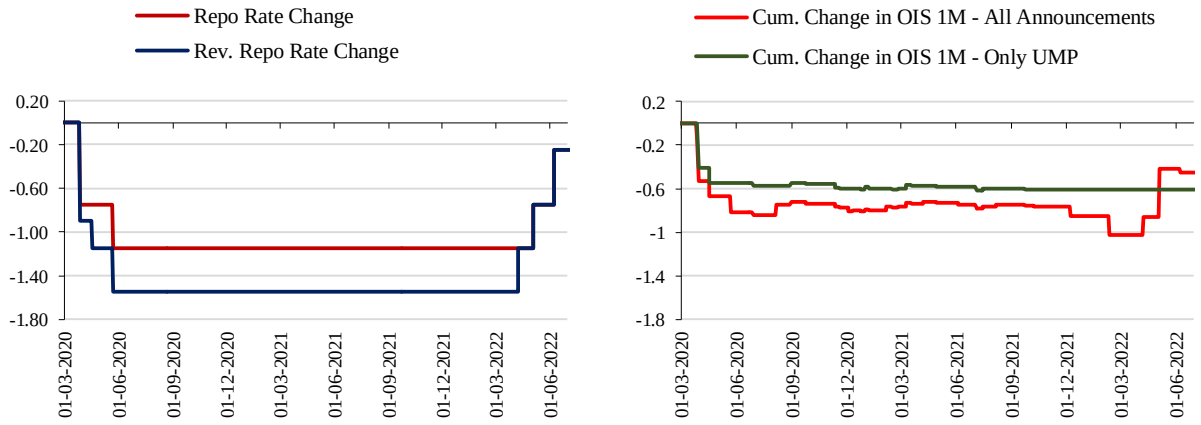
III.2. Impact of Conventional MP announcements

In our analysis so far, we have relied on studying the impact on the bond market exclusively on RBI announcement days. As we argued above, in principle expanding this analysis to a broader sample is desirable so that we can capture the full effect of RBI actions. However, the downside is that it is difficult to disentangle effects of RBI actions from other factors affecting the economy. We next turn to an analysis that tries to get an idea of how much "action" is going on in between the RBI announcements. In doing this analysis we will also focus on conventional policy actions of changes in short-term interest rates and forward guidance and the role these have played in the RBI's toolkit since the pandemic.

In the first year and a half of the pandemic, the RBI reduced the repo rate cumulatively by 115 basis points (first by 75 basis points on March 27, 2020 and then by 40 basis points on May 22, 2020). The reverse repo rate was cumulatively reduced by 155 basis points (90 bps on March 27, 2020 followed by 25 bps on April 17, 2020 and another 40 bps on May 22, 2020). All these rate decreases actually happened by May 22, 2020. This is shown in the left panel of Figure 2. The right panel of the figure shows the cumulative change in the 1-month OIS rate for all RBI announcements in the pandemic in the red line. The figure shows that by the end of May 2020, the 1-month OIS had decreased cumulatively by around 82 bps. This means that 82 bps out of the total 115 bps was a surprise to the market (at least in terms of its timing). In other words,

around 40 basis point reduction was cumulatively priced in by markets going into RBI meetings. This is evidence that RBI had effectively communicated in one form or another to the market of their future policy stance. As argued in recent work by Ahmed et al. (2022) and Lakdawala and Sengupta (2022), the RBI's forward guidance has been an effective tool in the transmission of monetary policy actions to financial markets. Moreover, Garga et al. (2022) show that since the adoption of flexible inflation targeting, the RBI has been able to credibly commit to the market that it is serious about inflation. Specifically, they show that markets expected RBI to respond more aggressively to respond to inflation since the adoption of inflation targeting.

Figure 2: Cumulative Effect of Policy Announcements on Policy and 1M OIS Rates during the Pandemic



Note: The above plot shows the cumulative daily change in the (a) policy repo rate and reverse repo rate; and (b) 1-month OIS rate during the pandemic sample. The daily change refers to the difference between yields on 't' and 't-1' day around the policy announcement. The graphs are for the period from January 2020 to June 2022.
Source: Authors' calculations.

IV. Forward Guidance by RBI

The RBI officially described its stance on forward guidance in a document titled "Communication policy of RBI" as follows[13]:

"*The RBI's approach to communicating the policy stance is to explain the stance with rationale, information and analysis but to refrain from explicit forward guidance with a preference for market participants and analysts to draw their own inferences.*"

[13] This archived document can be accessed at https://web.archive.org/web/20181029064140/https://rbi.org.in/Scripts/CommunicationPolicy.aspx.

In July 2021, during the pandemic, the RBI updated their communication policy (calling it "Version 2.0") where they removed the line about "refrain from explicit forward guidance" and replaced it with "The Reserve Bank explains the monetary policy measures and stance with the rationale, information and analysis to enable market participants and other stakeholders to provide clarity about its assessment of the evolving situation."[14]

To further understand the role of forward guidance and RBI communication in the pandemic, we follow the approach of Lakdawala and Sengupta (2022) and use OIS rates to construct the target and path factors in the spirit of Gurkaynak et al. (2005). The target factor captures surprise changes to the short-term policy rate. This is very similar to the raw changes in the 1-month OIS rates. The path factor is supposed to capture surprise movements in medium term rates (up to 1-year ahead) over and above the effect coming from short-term rate surprises. This is very highly correlated with the residual from regressing the 1-year OIS rate on the 1-month OIS rate. Figure 3 plots the target and path factor realizations for our pandemic sample from March 2020 to June 2022.

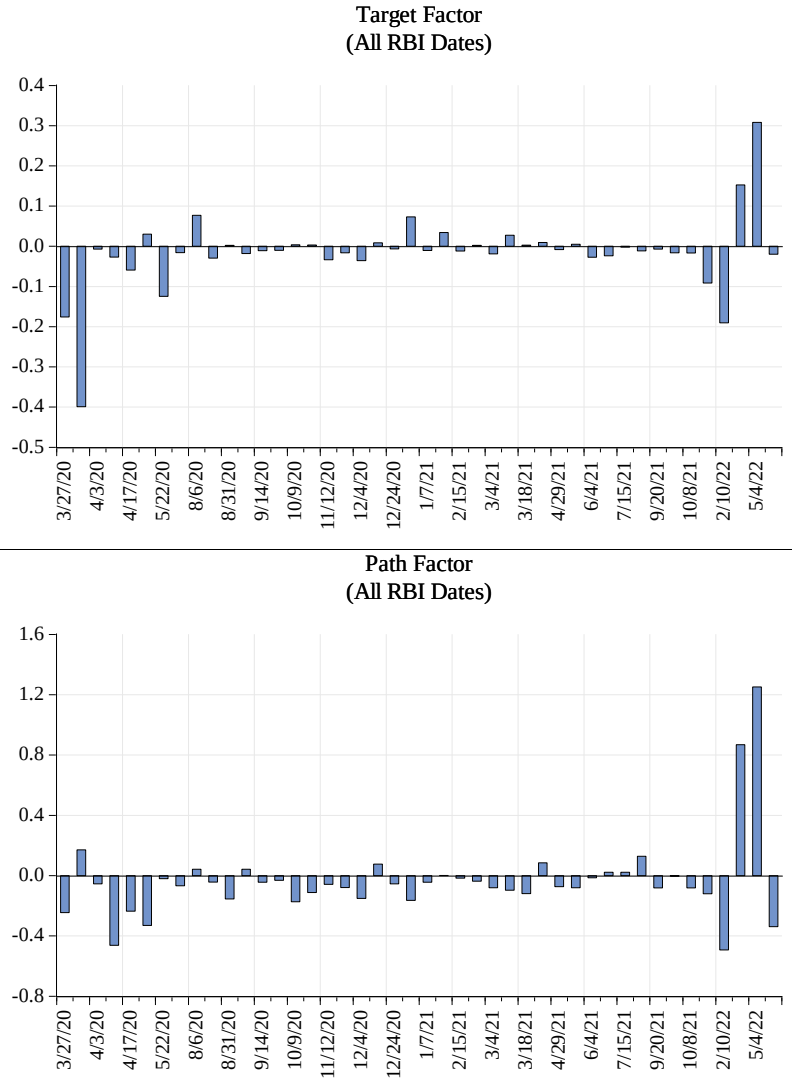
We conduct a narrative analysis similar to the one described in Section 2, for the top target and path factor dates, wherein we study media reports from the Economic Times to understand whether the biggest changes in the factors during our sample indeed reflected market surprise, either in response to RBI's policy rate surprises or in response to a change in RBI's communication or forward guidance. We also read through RBI's official statements to do a validation check. Our analysis reveals that typically there is a clear and intuitive link between the target/path factor shocks and RBI decisions, communication and related media coverage.

We look at the notable path factor dates to help us understand how the market reacted to the communication from the RBI. For example, the biggest path factor realisation in our sample period was on May 4, 2022, when the RBI hiked the policy repo rate by 40 bps in an unscheduled announcement for the first time since it had reduced the rate to 4 percent in May 2020. The RBI mentioned in the monetary statement: *"Core inflation is likely to remain elevated in the coming months...All these factors impart significant upside risks to the inflation trajectory... the risks to the near-term inflation outlook are rapidly materialising... the MPC*

[14] This new policy can be found at https://bit.ly/2V6sCIm.

expects inflation to rule at elevated levels, warranting resolute and calibrated steps to anchor inflation expectations and contain second round effects." The substantially positive path factor (1.252) captures this contractionary shock. The unscheduled announcement clearly took the market by surprise as reported by ET: "*the RBI's decision to act before its scheduled policy meet in June came as a bolt from the blue to markets.*"[15]

Figure 3: Monetary Policy Surprises during the Pandemic



Note: The above plots show the movement of the target and path factor, constructed using the approach of Lakdawala and Sengupta (2022), on the day of central bank policy announcements. Our sample period is from March 2020 to June 2022.

[15] https://economictimes.indiatimes.com/markets/stocks/news/key-takeaways-from-surprise-rbi-rate-hike-what-investors-should-look-for/articleshow/91319104.cms

Source: Authors' calculations.

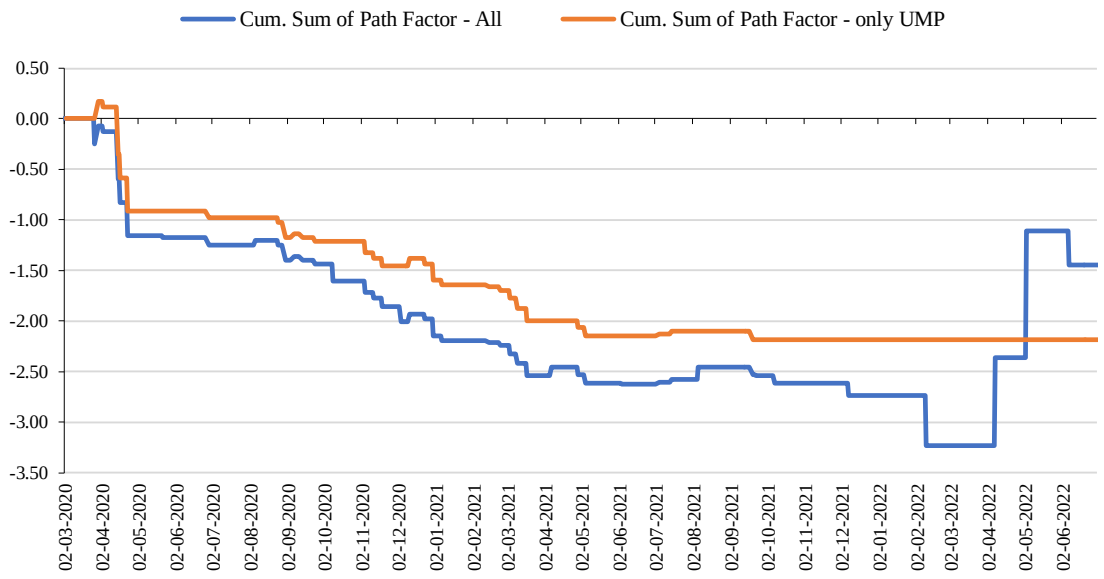
Another notable date was October 9, 2020 when over and above announcing on-tap TLTRO (as discussed in the previous section) the RBI gave explicit forward guidance in its monetary policy statement. Instead of the usual reiteration of monetary policy stance (for example, "The MPC also decided to continue with the accommodative stance as long as it is necessary to revive growth" as in the August 2020 statement), the October statement mentioned the following:

"The MPC also decided to continue with the accommodative stance as long as necessary – at least during the current financial year and into the next financial year – to revive growth on a durable basis…"

There was no rate action and hence the target factor was almost zero whereas the path factor for this date was -0.174 reflecting the expansionary shock.

Figure 4 shows the cumulated surprises of the path factor for the full pandemic sample. The blue line shows the cumulative changes on all announcement days while the orange line depicts only unconventional announcement days. There are a few interesting things to point out from this graph. First, we showed in Figure 2 above that expansionary surprise changes to the short-rate were clustered in the beginning of the pandemic and that by mid-2021 the cumulated 1-month OIS rate had bottomed out, staying there until the hiking cycle in 2022. For the path factor the story is quite different. While path factor surprises do trend downward in the first few months of the pandemic, they continue to fall over the entirety of the pandemic. This suggests that forward guidance shocks continued to have an expansionary effect on market interest rates in the latter part of 2021 and early 2022. Second, when comparing the blue and the yellow line, we notice that they are surprisingly close to each other. The yellow line only considers the unconventional monetary policy announcements. The fact that the yellow line is so close to the blue line suggests that most of the effects of forward guidance happened on days with unconventional monetary policy announcements. This is further evidence that the signaling channel of monetary policy is at play. Since unconventional monetary policy actions ceased in September 2021, we see that the contractionary forward guidance shocks in mid-2022 were all on RBI announcements about conventional actions.

Figure 4: Cumulative Effect of Policy Announcements on the Path Factor Surprises during the Pandemic



Note: The above plot shows the cumulative sum of the path factor during the pandemic sample on all announcement days and only UMP announcement days. Our sample period is from March 2020 to June 2022.
Source: Authors' calculations.

Since forward guidance appears to be an important component of the RBI toolkit in the pandemic, next we formally evaluate the direct effect of forward guidance shocks on the bond market. We conduct this analysis using an event-study framework of regressing changes in government bond yields on the target and path factors calculated from OIS rate changes on RBI announcement days. Details on data and sources have been provided in the Appendix. Summary statistics for the target and path factors for the pandemic sample together with a pre-pandemic sample that runs from January 2016 to February 2020 are shown in Appendix Table A4. The table shows that the properties of the target and path factor in the pandemic sample are qualitatively similar to the pre-pandemic sample.

In Tables 4 and 5, we present the results of regressing GSec yields (3-month, 1-year and 10-year) on the target and path factors. Table 4 shows the results for a pre-pandemic sample of January 2016 to February 2022. Focusing on the response of the 10-year GSec we notice that only the target factor is statistically significant. Moreover, the size of the target factor coefficient and he associated R^2 are much bigger relative to the path factor. This suggests that bond markets were responding mainly to surprise changes in the RBI's short-term interest rate changes rather than any forward guidance. In the pandemic sample, the story is quite different. Now only the path

factor is significant, and it explains substantially more of the variation in the 10-year GSec yields.

Table 4: Response of Sovereign Bond Yields to RBI Announcements: Pre-Pandemic Sample

	3M TBill Rate			1Y GSec Yield			10Y GSec Yield		
Indep. Var	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
C	-0.01	0.01	-0.01	-0.02	0.02	0.01	0.00	0.03	0.02
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Target Factor	0.60		0.57	0.49		0.30	0.59		0.48
	(0.05)***		(0.04)***	(0.22)**		(0.07)***	(0.10)***		(0.17)**
Path Factor		0.17	0.06		0.33	0.27		0.26	0.16
		(0.10)*	(0.03)		(0.06)***	(0.03)***		(0.12)***	(0.10)**
Obs.	25	25	25	25	25	25	25	25	25
Adj R-sq.	0.62	0.13	0.62	0.33	0.54	0.65	0.40	0.25	0.48
F-stat.	40.63	4.65	20.85	12.64	29.15	23.24	17.22	9.12	12.29

Note: The above table reports the regression estimates of daily change in sovereign bond yields (3-month TBill, 1-year and 10-year GSec yields) on target and path factors constructed using Lakdawala and Sengupta (2022) approach. The sample period consists of daily data beginning in January 2016 and ending in February 2020. Estimation has been carried out over RBI announcements days only. Adjusted standard errors are reported in the parentheses. *, **, *** correspond to 10%, 5% and 1% level of significance.
Source: Authors' calculations.

We conduct several robustness checks. First, for the pandemic sample, we include a daily measure of global risk aversion and uncertainty proposed by Bekaert et al. (2021) to control for global factors that maybe influencing domestic bond yields during the pandemic period. We report the results in Appendix Table A6. The path factor continues to be statistically significant implying our main result is robust to this specification. We also estimate the model using US VIX index as a proxy for uncertainty/risk aversion and our results hold. We do not report the results here for brevity. Next, we drop all such observations where announcements by the RBI were immediately preceded by policy announcements from the Federal Open Market Committee

(FOMC) of the US Fed and/or the European Central Bank (ECB)[16]. In such cases, announcements by the FOMC or the ECB could drive the changes in domestic bond yields. Shown in Appendix Table A7, we find that our results are also robust to dropping such observations. Thus, we conclude that the RBI's forward guidance has been effective in driving long-term interest rates in the pandemic sample.

Table 5: Response of Sovereign Bond Yields to RBI Announcements: Pandemic Sample

	3M TBill Rate			1Y GSec Yield			10Y GSec Yield		
Indep. Var	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
C	-0.03	-0.01	0.01	0.00	0.02	0.04	-0.01	0.01	0.01
	(0.01)*	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)*	(0.01)*
Target Factor	0.57		0.77	0.45		0.63	-0.09		0.02
	(0.81)		(0.74)*	(0.62)		(0.52)**	(0.12)		(0.05)
Path Factor		0.42	0.52		0.39	0.48		0.29	0.29
		(0.27)	(0.32)		(0.25)*	(0.25)*		(0.07)***	(0.07)***
Obs.	34	34	34	34	34	34	34	34	34
Adj R-sq.	0.07	0.11	0.26	0.03	0.09	0.19	0.01	0.37	0.35
F-stat.	3.50	5.16	6.89	2.11	4.40	4.76	0.47	20.57	9.99

Note: The above table reports the regression estimates of daily change in sovereign bond yields (3-month TBill, 1-year and 10-year GSec yields) on target and path factors constructed using Lakdawala and Sengupta (2022) approach. The sample period consists of daily data beginning from March 27, 2020 and ending in June 2022. Estimation has been carried out over unconventional monetary policy announcements days only. Adjusted standard errors are reported in the parentheses. *, **, *** correspond to 10%, 5% and 1% level of significance.
Source: Authors' calculations.

V. Conclusion

In recent years, unconventional monetary policies have been used regularly by central banks in advanced countries. However, some of the pandemic era monetary policies implemented by the

[16] We find that there were three days when RBI announcements were preceded by FOMC/ECB announcements - (a) RBI's December 11, 2020 announcement was preceded by ECB announcement of December 10, 2020; (b) Policy announcement by RBI on March 18, 2021 and April 29, 2021 were preceded by announcement of FOMC's decision on March 17, 2021 and April 28, 2021. We also find two overlapping policy days between RBI and FOMC, namely November 05, 2020 and May 04, 2022. However, these dates should not matter for Indian bond market given the time zone difference.

RBI were new and untested in the Indian context. In this paper we investigated the bond market response to these policies. Combining a narrative analysis with an event-study framework we find that the RBI's actions were responsible in keeping long-term interest rates low, especially in the start of the pandemic. We find that some of the unconventional monetary policy actions had a substantial signalling channel component where the market perceived the announcement of an unconventional monetary policy action as representing a lower future path for the short-term policy rate. We also find that the RBI's forward guidance was more effective in the pandemic than it had been in the couple of years preceding the pandemic.

In addition to documenting the effects of these policies our results have some implications the design of future monetary policy. One important finding is that unconventional measures implemented at the beginning of the pandemic were more effective than those that happened a year into the pandemic. Moreover, the initial announcements of the unconventional actions were more effective than subsequent expansions of the programs. Thus, a potential policy implication for the RBI is to strike quickly in response to the next crisis but also to wind down quickly.

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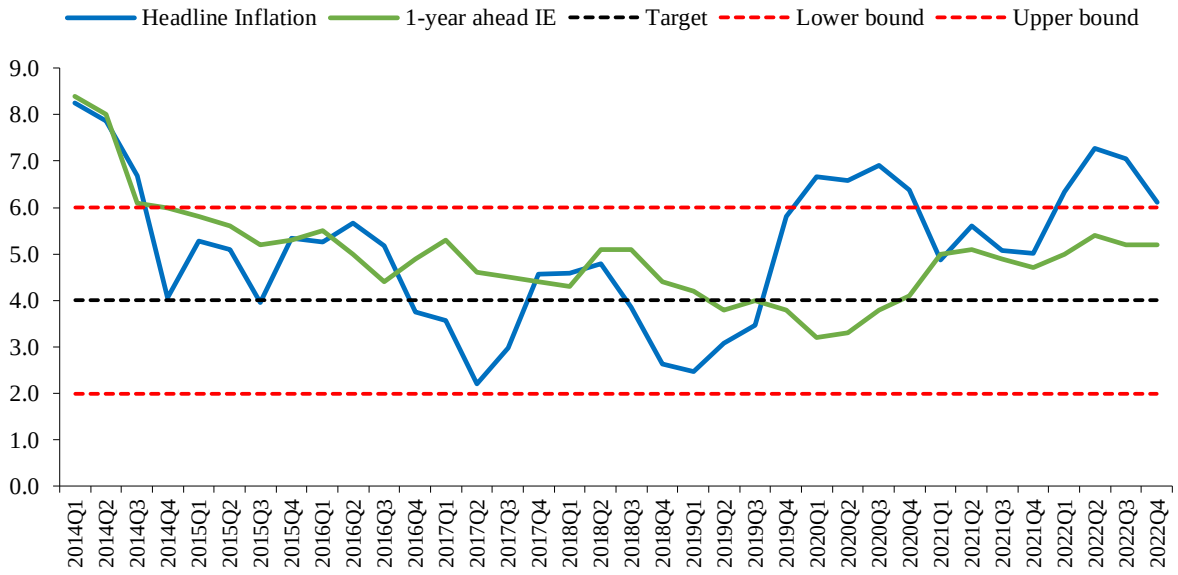
Appendix

Figure A1: Actual and Expected Inflation in India

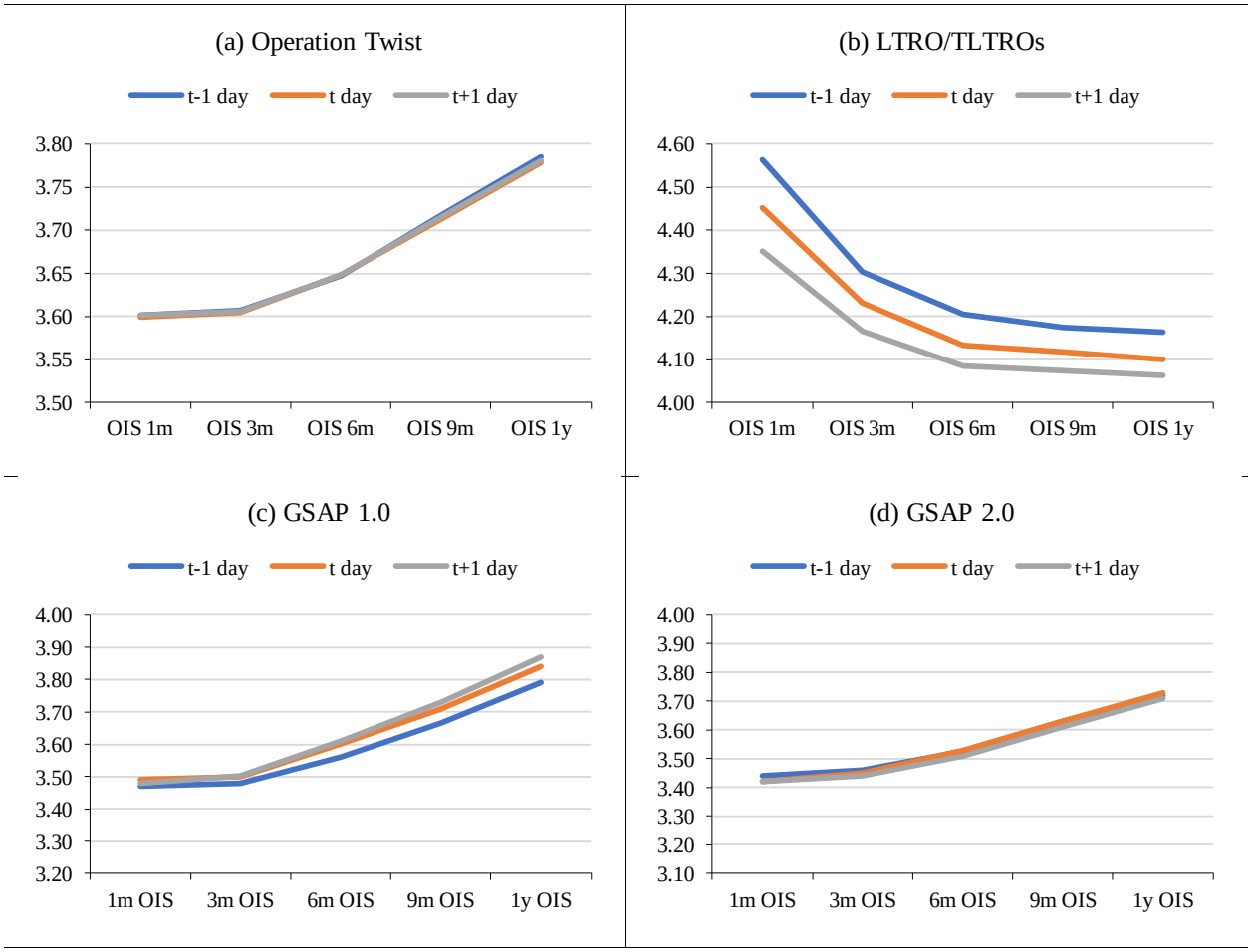


Note: The above chart shows the quarterly headline inflation and one year ahead expected inflation rate for India for Q1:2014 to Q4:2022. Headline inflation, shown by solid blue line, is measured in terms of year-on-year percentage change in consumer price index (CPI-combined). Inflation expectations, shown by solid green line, were taken from the Survey of Professional Forecasters' conducted by the RBI. The official target rate of inflation at 4 per cent, along with the +/- 2 per cent band, is shown using dotted black and red lines, respectively.
Source: Reserve Bank of India.

Figure A2: Long-term Interest Rates (10-Year Benchmark Government Bond Yield) in India

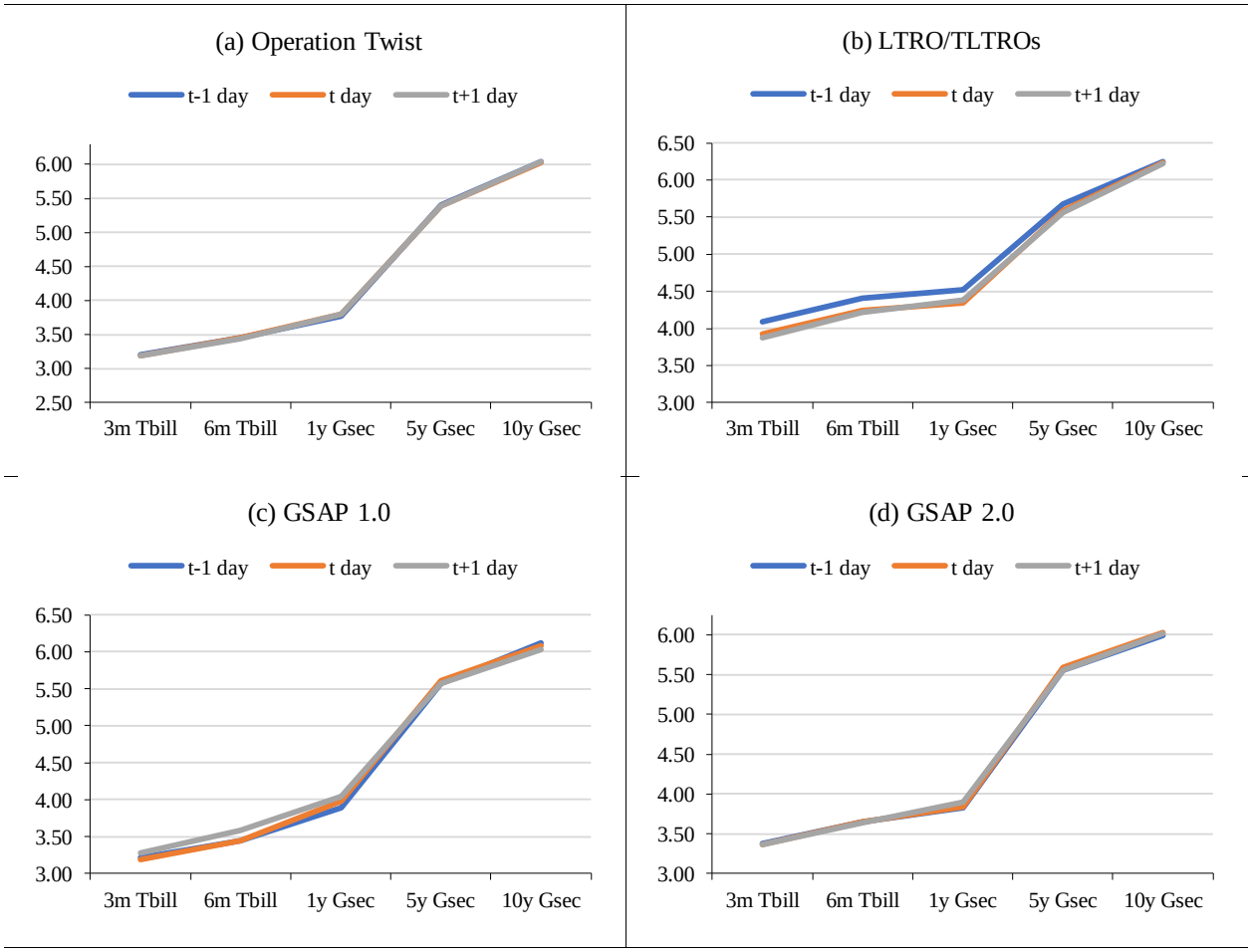
Note: The above figure shows the daily level of long-term interest rate proxied by the yield on 10-year Government Securities (GSec) for the period beginning March 2020 and ending in August 2022.
Source: Bloomberg.

Figure A3: Impact of Unconventional Monetary Policy Announcements on OIS Rates: The Signaling Channel of Monetary Policy



Note: The above figure shows the OIS yield curve one day prior (t-1), same day (t) and one day after (t+1) the announcement of (a) Operation Twist (OT) or simultaneous sale-purchase operations; (b) Normal/Targeted Long-term Repo Operations (LTRO/TLTROs); (c) G-Sec Acquisition Programme 1.0; and (d) G-Sec Acquisition Programme 2.0. Our sample period is from March 2020 to June 2022.
Source: Authors' calculations; Bloomberg.

Figure A4: Impact of Unconventional Monetary Policy Announcements on Sovereign Bond Yield Curve



Note: The above figure shows the government securities yield curve one-day prior (t-1), same day (t) and one day after (t+1) the announcement of (a) Operation Twist (OT) or simultaneous sale-purchase operations; (b) Normal/Targeted Long-term Repo Operations (LTRO/TLTROs); (c) G-Sec Acquisition Programme 1.0; and (d) G-Sec Acquisition Programme 2.0. In case of multiple announcements, rates have been averaged across all announcements. Our sample period is from March 2020 to June 2022.

Source: Authors' calculations; Bloomberg.

Table A1: Unconventional Monetary Policy Announcements by the RBI during Pandemic

Type of actions	*Description*
TLTRO (Targeted long-term repo operation)	Auctions of targeted term repos of up to three years tenor of appropriate sizes for a total amount of up to Rs. 1,00,000 crores at a floating rate, linked to the policy repo rate. Liquidity availed under the scheme by banks to be deployed in investment grade corporate bonds, commercial paper and non-convertible debentures over and above the outstanding level of their investments in these bonds as on March 25, 2020. Announced on March 27, 2020.
TLTRO 2.0	Targeted Long-Term Repo Operations at the policy repo rate for tenors up to three years for a total amount of up to Rs. 50,000 crores, to begin with, in tranches of appropriate sizes. The funds availed by banks under TLTRO 2.0 to be invested in investment grade bonds, commercial paper, and non-convertible debentures of NBFCs, with at least 50 per cent of the total amount availed going to small and mid-sized NBFCs and MFIs. Announced on April 17, 2020.
On-tap TLTRO	Targeted long-term repo operations with tenors of up to three years for a total amount of up to Rs. 1,00,000 crores at a floating rate linked to the policy repo rate. The scheme to be available up to March 31, 2021 with flexibility with regard to enhancement of the amount and period after a review of the response to the scheme. Liquidity availed by banks under the scheme to be deployed in corporate bonds, commercial papers, and non-convertible debentures issued by the entities in specific sectors over and above the outstanding level of their investments in such instruments as on September 30, 2020. The liquidity availed under the scheme could also be used to extend bank loans and advances to these sectors.
OT (Operation Twist)	Simultaneous purchase of long-term and sale of short-term government securities under Open Market Operations to compress the term premium and reduce the steepness of the yield curve. First announced in December 2019. First announcement during pandemic on April 23, 2020.
GSAP	A secondary market G-sec (government securities) acquisition programme or G-SAP 1.0 wherein the RBI committed upfront to a specific amount of open market purchases of GSecs. On April 7, 2021 RBI announced a G-SAP of Rs. 1 lakh crore for Q1:2021-22. GSAP 2.0 was announced on June 4, 2021 for Q2:2021-22 for secondary market purchase operations of Rs. 1.20 lakh crore to support the market.

Note: The above table provides a key summary of various types of unconventional monetary policy announcements made by the RBI in recent years.
Source: Reserve Bank of India.

Table A2: Monetary policy Announcement Dates by the RBI during the Pandemic

Date	*Type of action*	*Scheduled or unscheduled announcement*	*Description*
March 27, 2020	CMP+UMP	Unscheduled	Repo rate cut by 75bps to 4.4%, reverse repo rate cut by 90bps to 4%, CRR cut by 1% to 3%; TLTRO 1.0
March 30, 2020	UMP	Unscheduled	TLTRO
April 3, 2020	UMP	Unscheduled	TLTRO
April 15, 2020	UMP	Unscheduled	TLTRO
April 17, 2020	CMP+UMP	Unscheduled	Reverse repo rate lowered to 3.75%; TLTRO 2.0
April 23, 2020	UMP	Unscheduled	OT
May 22, 2020	CMP	Scheduled	Repo rate lowered to 4%, reverse repo rate to 3.35%, MSF rate to 4.25%
June 29, 2020	UMP	Unscheduled	OT
August 6, 2020	CMP	Scheduled	No rate changes
August 25, 2020	UMP	Unscheduled	OT
August 31, 2020	UMP	Unscheduled	OT
September 7, 2020	UMP	Unscheduled	OT
September 14, 2020	UMP	Unscheduled	OT
September 24, 2020	UMP	Unscheduled	OT
October 9, 2020	CMP	Scheduled	No rate changes
November 5, 2020	UMP	Unscheduled	OT
November 12, 2020	UMP	Unscheduled	OT
November 19, 2020	UMP	Unscheduled	OT
December 4, 2020	CMP	Scheduled	No rate changes
December 11, 2020	UMP	Unscheduled	OT
December 24, 2020	UMP	Unscheduled	OT
December 31, 2020	UMP	Unscheduled	OT
January 7, 2021	UMP	Unscheduled	OT
February 5, 2021	CMP	Scheduled	No LAF rate changes; CRR raised to 4% (in 2

			phases)
February 15, 2021	UMP	Unscheduled	OT
February 24, 2021	UMP	Unscheduled	OT
March 4, 2021	UMP	Unscheduled	OT
March 10, 2021	UMP	Unscheduled	OT
March 18, 2021	UMP	Unscheduled	OT
April 7, 2021	CMP+UMP	Scheduled	No rate changes; GSAP 1.0
April 29, 2021	UMP	Unscheduled	OT
May 5, 2021	UMP	Unscheduled	GSAP 1.0
June 4, 2021	CMP+UMP	Scheduled	No rate changes; GSAP 1.0
July 5, 2021	UMP	Unscheduled	GSAP 2.0
July 15, 2021	UMP	Unscheduled	GSAP 2.0
August 6, 2021	CMP	Scheduled	No rate changes; GSAP 2.0
September 20, 2021	UMP	Unscheduled	GSAP 2.0; OT
September 23, 2021	UMP	Unscheduled	GSAP 2.0; OT
October 8, 2021	CMP	Scheduled	No rate changes
December 8, 2021	CMP	Scheduled	No rate changes
April 8, 2022	CMP	Scheduled	Rev repo rate replaced with SDF rate increased to 3.75%
May 4, 2022	CMP	Unscheduled	Repo rate raised to 4.4%, SDF rate to 4.15%, MSF rate to 4.65%; CRR raised to 4.5%
June 8, 2022	CMP	Scheduled	Repo rate raised to 4.9%, SDF rate to 4.65%, MSF rate to 5.15%

Note: The above table provides a list of all policy announcements made by the RBI between March 2020 and June 2022. Details on the date of the policy announcement, a categorization into conventional monetary policy (CMP) and unconventional monetary policy (UMP), whether scheduled/unscheduled and key features, including policy rate changes, have been provided in the table.
Source: Reserve Bank of India.

Table A3: Response of Government Bond Yields to Central Bank Announcements Before the Pandemic: Summary Statistics

Security	*CMP Dates*		*All Other Dates*	
Daily change (%)	Mean	Std. Dev.	Mean	Std. Dev.
3M T-bill Rate	-0.004	0.094	-0.002	0.037
1Y GSec Rate	-0.011	0.102	-0.001	0.049
10Y GSec Rate	0.011	0.112	-0.001	0.044

Note: The above table reports the mean and standard deviation of daily change in government bond yields (3-month, 1-year and 10-year) on days of conventional monetary policy (CMP) announcement days and all other days between 01/01/2020 to 26/03/2020 period. The sample consists of 25 CMP announcement days.
Source: Authors' calculations.

Table A4: Target and Path Factors in pre- and post-Pandemic Period: Summary Statistics

	Target Factor		*Path Factor*	
	Pre-Pandemic	*Post-Pandemic*	*Pre-Pandemic*	*Post-Pandemic*
Mean	0.014	-0.015	-0.085	-0.033
Median	0.002	-0.011	-0.078	-0.056
Max	0.351	0.308	0.464	1.252
Min	-0.347	-0.399	-0.489	-0.493
Std. Deviation	0.125	0.095	0.232	0.279
Skewness	0.030	-0.753	0.648	2.825
Kurtosis	6.176	10.539	3.206	13.691
Observations	25	44	25	44

Note: The above table shows the summary statistics for the target and path factors constructed using Lakdawala and Sengupta (2022) approach. The pre-pandemic period refers to 01/01/2016 – 06/02/2020 while post-pandemic sample corresponds with period between 27/03/2020 and 08/06/2022.
Source: Authors' calculations.

Table A5: Data and Sources

S. No.	Data	Source
1.	3M Tbill Rate (%)	Thomson Reuters
2.	1Y Benchmark GSec Yield (%)	Thomson Reuters
3.	10Y Benchmark GSec Yield (%)	Thomson Reuters
4.	Overnight Indexed Swap Rates (%) - Various Maturities	Bloomberg
5.	Target and Path Factor Monetary Policy Surprises	Authors calculations following Lakdawala and Sengupta (2022)
6.	RBI Policy Announcement Dates	Reserve Bank of India website (www.rbi.org.in)

Table A6: Response of Sovereign Bond Yields to RBI Announcements: Pandemic Sample with global risk aversion and uncertainty index

	3M TBill Rate			1Y GSec Yield			10Y GSec Yield		
Indep. Var	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
C	0.00	-0.01	0.02	0.03	0.01	0.04	-0.01	0.01	0.01
	(0.01)	(0.01)	(0.02)	(0.02)*	(0.02)	(0.02)***	(0.01)	(0.01)	(0.01)
Target Factor	1.22		1.22	1.08		1.08	-0.06		-0.05
	(0.41)***		(0.41)***	(0.16)***		(0.15)***	(0.12)		(0.11)
Path Factor		0.27	0.28		0.19	0.19		0.31	0.31
		(0.12)**	(0.16)*		(0.12)	(0.13)		(0.07)***	(0.07)***
ΔGRA_{t-1}	0.15	0.06	0.13	0.15	0.07	0.13	0.008	-0.02	-0.02
	(0.07)**	(0.05)	(0.07)*	(0.05)***	(0.04)	(0.05)***	(0.03)	(0.02)	(0.02)
Obs.	31	31	31	31	31	31	31	31	31
Adj R-sq.	0.46	0.14	0.49	0.42	0.14	0.42	0.01	0.35	0.33
F-stat.	13.68	3.43	10.63	11.68	3.42	8.26	0.35	8.95	5.86

Note: The above table reports the regression estimates of daily change in sovereign bond yields (3-month TBill, 1-year and 10-year GSec yields) on target and path factors constructed using Lakdawala and Sengupta (2022) approach and lagged daily change in global risk aversion (GRA) proposed by Bekaert et al. (2021). The sample period consists of daily data beginning from March 27, 2020 and ending in June 2022. Estimation has been carried out over unconventional monetary policy announcements days only. Adjusted standard errors are reported in the parentheses. *, **, *** correspond to 10%, 5% and 1% level of significance.

Source: Authors' calculations.

Table A7: Response of Sovereign Bond Yields to RBI Announcements: Pandemic Sample without coinciding announcement dates

	3M TBill Rate			1Y GSec Yield			10Y GSec Yield		
Indep. Var	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
C	-0.03	-0.01	0.02	0.01	0.02	0.05	-0.01	0.01	0.01
	(0.02)*	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)**	(0.01)	(0.01)	(0.01)
Target Factor	0.56		0.78	0.46		0.66	-0.10		0.01
	(0.40)		(0.39)*	(0.34)		(0.29)**	(0.06)		(0.04)
Path Factor		0.42	0.54		0.40	0.51		0.29	0.29
		(0.26)	(0.35)		(0.22)*	(0.27)*		(0.05)***	(0.06)***
Obs.	31	31	31	31	31	31	31	31	31
Adj R-sq.	0.06	0.11	0.26	0.03	0.10	0.20	0.01	0.37	0.35
F-stat.	3.07	4.60	6.26	2.01	4.15	4.69	0.59	18.51	8.95

Note: The above table reports the regression estimates of daily change in sovereign bond yields (3-month TBill, 1-year and 10-year GSec yields) on target and path factors constructed using Lakdawala and Sengupta (2022) approach. The sample period consists of daily data beginning from March 27, 2020 and ending in June 2022. Estimation has been carried out over unconventional monetary policy announcements days only. Adjusted standard errors are reported in the parentheses. *, **, *** correspond to 10%, 5% and 1% level of significance.
Source: Authors' calculations.